PB-250 577

COFFEEN LAKE, MONTGOMERY COUNTY, ILLINOIS

Pacific Northwest Environmental Research Laboratory

Prepared for:

National Environmental Research Center

June 1975

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TECHNICAL REPORT DATA
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1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Report on Coffeen Lake, Montgomery County, Illinois		5. REPORT DATE Prepared June 1975 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Anonymous (National Eutrophication Survey Staff)		8. PERFORMING ORGANIZATION REPORT NO. Working Paper # 300
9. PERFORMING ORGANIZATION NAME AND ADDRESS Pacific Northwest Environmental Research Laboratory U.S. Environmental Protection Agency 200 S. W. 35th St. Corvallis, Oregon 97330		10. PROGRAM ELEMENT NO. 1BA029 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Office of Research and Development U.S. Environmental Protection Agency 401 M Street, S. W. Washington, DC 20460		13. TYPE OF REPORT AND PERIOD COVERED Final - 1973 14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

Prepared in cooperation with the U.S. Environmental Protection Agency, National Environmental Research Center, Las Vegas, Nevada 89114

16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
eutrophication lakes nutrients phosphorus nitrogen loading		05B 05C

PRICES SUBJECT TO CHANGE

18. DISTRIBUTION STATEMENT Release unlimited	19. SECURITY CLASS (This Report)	21. NO. OF PAGES 36
	20. SECURITY CLASS (This page)	22. PRICE $4.00

EPA Form 2220-1 (9-73)

PB 250 577

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES

CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON

and

ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

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REPORT
ON
COFFEEN LAKE
MONTGOMERY COUNTY
ILLINOIS
EPA REGION V
WORKING PAPER No. 300

WITH THE COOPERATION OF THE

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

AND THE

ILLINOIS NATIONAL GUARD

JUNE, 1975

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Illinois Environmental Protection Agency for professional involvement and to the Illinois National Guard for conducting the tributary sampling phase of the Survey.

Dr. Richard H. Briceland, Director of the Illinois Environmental Protection Agency; and Ronald M. Barganz, State Survey Coordinator, and John J. Forneris, Manager of Region III, Field Operations Section of the Division of Water Pollution Control, provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

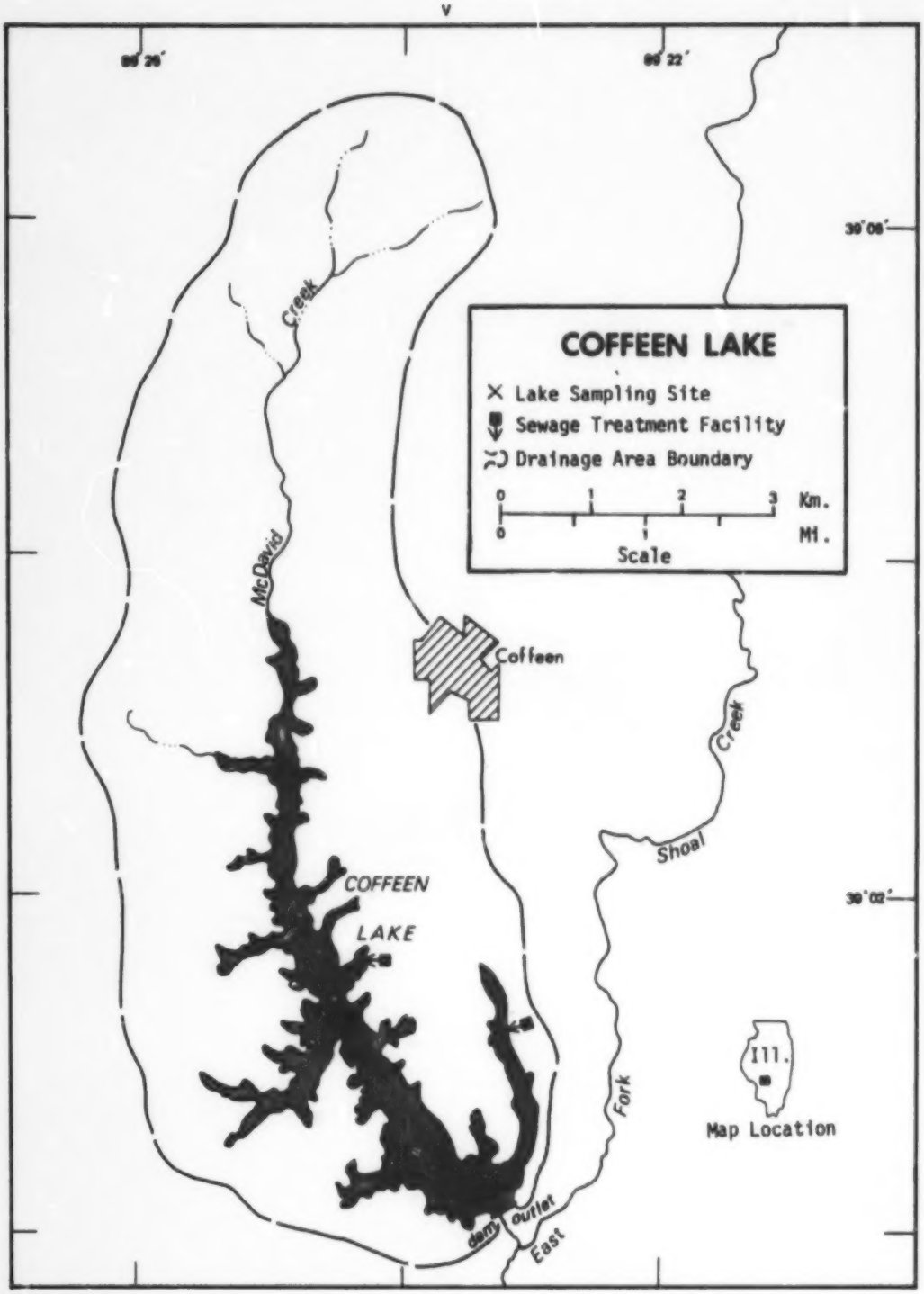
Major General Harold R. Patton, the Adjutant General of Illinois, and Project Officer Colonel Daniel L. Fane, who directed the volunteer efforts of the Illinois National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF ILLINOIS

LAKE NAME	COUNTY
Baldwin	Randolph
Bloomington	McLean
Carlyle	Bond, Clinton, Fayette
Cedar	Lake
Charleston	Coles
Coffeen	Montgomery
Crab Orchard	Jackson, Williamson
Decatur	Macon
DePue	Bureau
East Loon	Lake
Fox	Lake
Grass	Lake
Highland Silver	Madison
Holiday	LaSalle
Horseshoe	Madison
Long	Lake
Lou Yaeger	Montgomery
Marie	Lake
Old Ben Mine	Franklin
Pistakee	Lake, McHenry
Raccoon	Marion
Rend	Franklin, Jefferson
Sangchris	Christian
Shelbyville	Moultrie, Shelby
Slocum	Lake
Springfield	Sangamon
Storey	Knox
Vandalia	Fayette
Vermilion	Vermilion
Wee Ma Tuk	Fulton
Wonder	McHenry


COFFEEN LAKE
Lake Sampling Site
Sewage Treatment Facility
Drainage Area Boundary
0 1 2 3 Km.
0 1 Mi.
Scale
Coffeen
McDavid
Creek
COFFEEN
LAKE
Shoal
Creek
East
Fork
dam
outlet
Ill.
Map Location
39°08'
39°02'

COFFEEN LAKE

STORET NO. 1711

I. INTRODUCTION

Coffeen Lake was included in the National Eutrophication Survey as a water body of interest to the Illinois Environmental Protection Agency. This report relates to point sources of nutrients and lake water quality only. Tributaries and the lake outlet were not sampled.

II. CONCLUSIONS

A. Trophic Condition:

Survey data show that Coffeen Lake is eutrophic. It ranked third in overall trophic quality when the 31 Illinois lakes sampled in 1973 were compared using a combination of six parameters*. One lake had less median total phosphrous, two had less and one had the same median dissolved phosphorus, seven had less median inorganic nitrogen, two had less mean chlorophyll a, and two had greater mean Secchi disc transparency. Dissolved oxygen was nearly depleted at stations 1 and 2 in August and at station 1 in October.

Survey limnologists noted extensive growths of rooted aquatic vegetation.

B. Rate-Limiting Nutrient:

The algal assay results indicate Coffeen Lake was phosphorus limited at the time the sample was collected (08/10/73). The

* See Appendix A.

lake data indicate phosphorus limitation in May as well but nitrogen limitation in October.

C. Nutrient Controllability:

The only nutrient loads to the lake that were measured during the Survey were from the Hillsboro Mine and Coffeen Power Plant wastewater treatment plants which discharge directly to the lake. It is calculated that these two sources collectively discharged 40 kg of total phosphorus and 275 kg of total nitrogen to the lake during the sampling year. The phosphorus contributions of these plants alone resulted in a loading rate of less than 0.01 $g/m^2/yr$. Since the loading rate proposed by Vollenweider (Vollenweider and Dillon, 1974) as an oligotrophic rate is 0.45 $g/m^2/yr$ (see page 11), it does not seem likely that phosphorus removal at the two treatment plants would result in a significant improvement in the trophic condition of Coffeen Lake.

III. LAKE CHARACTERISTICS†

A. Lake Morphometry*:

1. Surface area: 4.86 kilometers^2.
2. Mean depth: 5.6 meters.
3. Maximum depth: >13.7 meters.
4. Volume: 27.216 x 10^6 m^3.
5. Mean hydraulic retention time: 3 months.

B. Precipitation**:

1. Year of sampling: 127.8 centimeters.
2. Mean annual: 94.9 centimeters.

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† Table of metric conversions--Appendix B.
* Forneris, 1973.
** See Working Paper No. 175, "...Survey Methods, 1973-1976".

IV. LAKE WATER QUALITY SUMMARY

Coffeen Lake was sampled three times during the open-water season of 1973 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from three stations on the lake and from a number of depths at each station (see map, page v). During each visit, a single depth-integrated (4.6 m or near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the August visit, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 13.7 meters at station 1, 9.4 meters at station 2, and 3.4 meters at station 3.

The lake sampling results are presented in full in Appendix C and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR COFFEEN LAKE
STORET CODE 1741

PARAMETER	1ST SAMPLING (5/ 7/73) 3 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (8/10/73) 3 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (10/18/73) 3 SITES RANGE	MEAN	MEDIAN
TEMP (C)	13.7 - 23.8	18.7	19.0	14.1 - 37.9	29.3	30.1	13.9 - 28.2	22.6	22.9
DISS OXY (MG/L)	5.2 - 8.6	7.6	8.0	0.1 - 8.0	3.7	5.2	1.0 - 8.0	6.0	7.1
CNDCTVY (MCROMO)	430. - 505.	482.	495.	404. - 641.	539.	537.	469. - 590.	521.	520.
PH (STAND UNITS)	7.2 - 8.1	7.9	7.9	7.0 - 8.6	7.6	7.2	7.5 - 8.2	7.8	7.9
TOT ALK (MG/L)	73. - 77.	75.	74.	70. - 105.	77.	75.	74. - 138.	84.	81.
TOT P (MG/L)	0.028 - 0.067	0.040	0.032	0.025 - 0.065	0.040	0.034	0.022 - 0.343	0.055	0.027
ORTHO P (MG/L)	0.003 - 0.026	0.011	0.008	0.004 - 0.022	0.011	0.010	0.011 - 0.297	0.036	0.013
NO2+NO3 (MG/L)	0.410 - 0.580	0.454	0.435	0.030 - 0.370	0.139	0.100	0.020 - 0.140	0.062	0.060
AMMONIA (MG/L)	0.050 - 0.100	0.074	0.070	0.030 - 0.820	0.142	0.045	0.020 - 1.980	0.193	0.040
KJEL N (MG/L)	0.400 - 0.700	0.493	0.500	0.600 - 1.700	0.850	0.850	0.400 - 2.500	0.662	0.500
INORG N (MG/L)	0.460 - 0.660	0.528	0.510	0.060 - 0.860	0.281	0.150	0.060 - 2.000	0.255	0.180
TOTAL N (MG/L)	0.820 - 1.160	0.947	0.915	0.690 - 1.740	0.989	0.945	0.480 - 2.520	0.724	0.550
CHLRPYL A (UG/L)	3.7 - 11.7	7.0	5.7	5.7 - 18.4	10.2	6.6	5.1 - 6.9	5.8	5.5
SECCHI (METERS)	0.6 - 1.3	1.0	1.2	0.8 - 1.1	0.9	0.9	0.9 - 1.8	1.4	1.4

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal units per ml
05/07/73	1. *Nitzschia sp.*	7,837
	2. Flagellates	635
	3. Centric diatoms	282
	4. Green lunate cells	247
	5. *Oscillatoria sp.*	177
	Other genera	353
	Total	9,531
08/10/73	1. *Oscillatoria sp.*	2,825
	2. *Nitzschia sp.*	900
	3. *Raphidiopsis sp.*	300
	4. *Dactylococcopsis sp.*	177
	5. *Scenedesmus sp.*	71
	Other genera	159
	Total	4,432
10/18/73	1. *Nitzschia sp.*	271
	2. *Cyclotella sp.*	204
	3. *Ankistrodesmus sp.*	115
	4. *Oscillatoria sp.*	89
	5. *Lyngbya sp.*	80
	Other genera	30
	Total	789

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/l)
05/07/73	01	3.7
	02	5.7
	03	11.7
08/10/73	01	5.7
	02	6.6
	03	18.4
10/18/73	01	5.1
	02	5.5
	03	6.9

C. Limiting Nutrient Study:

1. Filtered and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.015	0.270	0.7
0.050 P	0.065	0.270	5.1
0.050 P + 1.0 N	0.065	1.270	14.0
1.0 N	0.015	1.270	1.1

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Coffeen Lake was moderate at the time the sample was collected (08/10/73). Also, the results indicate the lake was phosphorus limited at that time. Note that the addition of orthophosphorus resulted in a marked increase in yield, but the addition of only nitrogen did not.

The lake data indicate phosphorus limitation in May as well (the mean inorganic nitrogen/orthophosphorus ratio = 26/1) but nitrogen limitation in October (the mean N/P = 7/1).

V. NUTRIENT LOADINGS
(See Appendix D for waste treatment plant data)

Coffeen Lake was included in the National Eutrophication Survey as a water body of interest to the Illinois Environmental Protection Agency, and the tributary nutrient loads were not determined. However, the operators of the Hillsboro Mine and Coffeen Power Plant wastewater treatment plants provided monthly effluent samples and corresponding flow data.

A. Waste Sources:

1. Known treatment plants -

Name	Pop. Served	Treatment	Mean Flow (m^3/d)	Receiving Water
Coffeen Power Plant*	50	sand filter	22.7	Coffeen Lake
Hillsboro Mine**	110	act. sludge	106.0	Coffeen Lake

2. Known industrial - None

* DeSollar, 1973.
** Smith, 1973.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/ yr	% of total
a. Tributaries (non-point load) -		
none sampled	-	-
b. Minor tributaries & immediate drainage (non-point load) -	-	-
c. Known treatment plants -		
Hillsboro Mine	25	20.0
Coffeen Power Plant	15	12.0
d. Septic tanks - Unknown	-	-
e. Known industrial - None	-	-
f. Direct precipitation* -	85	68.0
Total	125	100.0

* See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/ yr	% of total
a. Tributaries (non-point load) -		
none sampled	-	-
b. Minor tributaries & immediate drainage (non-point load) -	-	-
c. Known treatment plants -		
Hillsboro Mine	160	2.9
Coffeen Power Plant	115	2.1
d. Septic tanks - Unknown	-	-
e. Known industrial - None	-	-
f. Direct precipitation* -	5,250	95.0
Total	5,525	100.0

* See Working Paper No. 175.

D. Yearly Loading Rates:

In the following table, the phosphorus loading rate attributable to the two point sources is compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" rate is the rate at which the receiving water would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus	Total Nitrogen
grams/m^2/yr	<0.01	0.06

Vollenweider loading rates for phosphorus ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Coffeen Lake:

"Dangerous" (eutrophic rate)	0.90
"Permissible" (oligotrophic rate)	0.45

V. LITERATURE REVIEWED

DeSollar, Richard W., 1973. Treatment plant questionnaire (Coffeen Power Plant STP). Coffeen.

Forneris, John J., 1973. Personal communication (lake morphometry). IL Env. Prot. Agency, Springfield.

Smith, Earl D., 1973. Treatment plant questionnaire (Hillsboro Mine STP). Pinckneyville.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
1703	LAKE BLOOMINGTON	0.050	5.730	464.667	26.200	14.800	0.020
1706	LAKE CARLYLE	0.084	1.270	477.889	17.367	11.000	0.032
1708	LAKE CHARLESTON	0.160	4.680	490.667	12.000	8.400	0.065
1711	COFFEEN LAKE	0.032	0.260	456.222	7.700	14.900	0.012
1712	CRAB ORCHARD LAKE	0.082	0.200	482.222	59.867	13.600	0.013
1714	LAKE DECATUR	0.129	3.750	474.571	43.000	14.500	0.062
1725	LONG LAKE	0.704	1.190	482.667	49.333	8.800	0.398
1726	LAKE LOU YAEGER	0.186	1.600	489.583	10.662	11.400	0.076
1727	LAKE MARIE	0.098	0.370	467.667	39.533	14.700	0.057
1733	PISTAKEE LAKE	0.203	0.370	485.667	75.867	7.000	0.062
1735	RENO LAKE	0.071	0.210	471.500	23.533	12.700	0.012
1739	LAKE SHELBYVILLE	0.062	3.290	461.333	17.161	14.800	0.019
1740	SILVER LAKE (HIGHLAND)	0.226	0.970	489.500	5.822	14.800	0.057
1742	LAKE SPRINGFIELD	0.109	3.265	483.385	13.013	10.800	0.059
1748	VERMILION LAKE	0.109	4.695	481.500	31.150	14.200	0.050
1750	WONDER LAKE	0.426	0.890	486.000	98.533	7.800	0.132
1751	LAKE STORY	0.072	2.510	459.333	17.250	14.800	0.021
1752	DEPUE LAKE	0.438	4.050	490.000	58.833	7.600	0.276
1753	LAKE SANGCHRIS	0.050	1.970	475.417	19.292	14.500	0.009
1754	LAKE HOLIDAY	0.167	3.135	485.167	51.217	7.200	0.046
1755	FOX LAKE	0.219	0.375	486.167	63.850	8.800	0.083
1756	GRASS LAKE	0.301	0.820	481.000	83.500	5.900	0.093
1757	EAST LOON LAKE	0.076	0.120	450.000	22.300	14.900	0.018
1758	SLOCUM LAKE	0.865	0.200	487.333	221.100	5.600	0.302
1759	CEDAR LAKE	0.029	0.170	400.333	5.767	12.800	0.013
1761	LAKE WEMATUK	0.069	1.770	466.333	7.967	14.500	0.031
1762	RACCOON LAKE	0.106	0.310	484.333	19.217	13.800	0.020
1763	BALDWIN LAKE	0.044	0.140	461.167	11.333	13.200	0.007

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
1764	LAKE VANDALIA	0.116	0.480	478.111	11.276	14.800	0.023
1765	OLD BEN MINE RESERVOIR	0.930	0.205	478.333	31.433	11.200	0.575
1766	HORSESHOE LAKE	0.127	0.705	482.833	182.250	6.800	0.018

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
1703	LAKE BLOOMINGTON	88 (26)	0 (0)	80 (24)	47 (14)	13 (2)	68 (20)	296
1706	LAKE CARLYLE	63 (19)	40 (12)	63 (19)	63 (19)	63 (19)	53 (16)	345
1708	LAKE CHARLESTON	37 (11)	7 (2)	0 (0)	77 (23)	77 (23)	27 (8)	225
1711	COFFEEN LAKE	97 (29)	77 (23)	93 (28)	93 (28)	2 (0)	92 (27)	454
1712	CRAB ORCHARD LAKE	67 (20)	90 (27)	43 (13)	20 (6)	42 (12)	85 (25)	347
1714	LAKE DECATUR	40 (12)	13 (4)	53 (16)	33 (10)	30 (8)	32 (9)	201
1725	LONG LAKE	7 (2)	43 (13)	40 (12)	30 (9)	72 (21)	3 (1)	195
1726	LAKE LOU YAEGER	30 (9)	37 (11)	7 (2)	87 (26)	57 (17)	23 (7)	241
1727	LAKE MARIE	60 (18)	68 (20)	73 (22)	37 (11)	23 (7)	42 (12)	303
1733	PISTAKEE LAKE	27 (8)	68 (20)	23 (7)	13 (4)	90 (27)	32 (9)	253
1735	RENO LAKE	77 (23)	80 (24)	70 (21)	50 (15)	53 (16)	92 (27)	422
1739	LAKE SHELBYVILLE	83 (25)	17 (5)	83 (25)	70 (21)	13 (2)	73 (22)	339
1740	SILVER LAKE (HIGHLAND)	20 (6)	47 (14)	10 (3)	97 (29)	13 (2)	42 (12)	229
1742	LAKE SPRINGFIELD	53 (16)	20 (6)	33 (10)	73 (22)	67 (20)	37 (11)	283
1748	VERMILION LAKE	50 (15)	3 (1)	47 (14)	43 (13)	37 (11)	47 (14)	227
1750	WONDER LAKE	13 (4)	50 (15)	20 (6)	7 (2)	80 (24)	13 (4)	183
1751	LAKE STORY	73 (22)	27 (8)	90 (27)	67 (20)	13 (2)	63 (19)	333
1752	DEPUE LAKE	10 (3)	10 (3)	3 (1)	23 (7)	83 (25)	10 (3)	139
1753	LAKE SANGCHRIS	88 (26)	30 (9)	67 (20)	57 (17)	30 (8)	97 (29)	369
1754	LAKE HOLIDAY	33 (10)	23 (7)	27 (8)	27 (8)	87 (26)	50 (15)	247
1755	FOX LAKE	23 (7)	63 (19)	17 (5)	17 (5)	72 (21)	20 (6)	212
1756	GRASS LAKE	17 (5)	53 (16)	50 (15)	10 (3)	97 (29)	17 (5)	244
1757	EAST LOON LAKE	70 (21)	100 (30)	97 (29)	53 (16)	2 (0)	77 (23)	399
1758	SLOCUM LAKE	3 (1)	87 (26)	13 (4)	0 (0)	100 (30)	7 (2)	210
1759	CEDAR LAKE	100 (30)	93 (28)	100 (30)	100 (30)	50 (15)	85 (25)	528
1761	LAKE WENATUK	80 (24)	33 (10)	77 (23)	90 (27)	30 (8)	57 (17)	367
1762	RACCOON LAKE	57 (17)	73 (22)	30 (9)	60 (18)	42 (12)	68 (20)	330
1763	BALDWIN LAKE	93 (28)	97 (29)	87 (26)	80 (24)	47 (14)	100 (30)	504

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
1764	LAKE VANDALIA	47 (14)	60 (18)	60 (18)	83 (25)	13 (2)	60 (18)	323
1765	OLD BEN MINE RESERVOIR	0 (0)	83 (25)	57 (17)	40 (12)	60 (18)	0 (0)	246
1766	HORSESHOE LAKE	43 (13)	57 (17)	37 (11)	3 (1)	93 (28)	80 (24)	313

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	1759	CEDAR LAKE	528
2	1763	BALDWIN LAKE	504
3	1711	COFFEEN LAKE	454
4	1735	RENO LAKE	422
5	1757	EAST LOON LAKE	399
6	1753	LAKE SANGCHRIS	369
7	1761	LAKE WEMATUK	367
8	1712	CRAB ORCHARD LAKE	347
9	1706	LAKE CARLYLE	345
10	1739	LAKE SHELBYVILLE	339
11	1751	LAKE STORY	333
12	1762	RACCOON LAKE	330
13	1764	LAKE VANDALIA	323
14	1766	HORSESHOE LAKE	313
15	1727	LAKE MARIE	303
16	1703	LAKE BLOOMINGTON	296
17	1742	LAKE SPRINGFIELD	283
18	1733	PISTAKEE LAKE	253
19	1754	LAKE HOLIDAY	247
20	1756	GRASS LAKE	244
21	1726	LAKE LOU YAEGER	241
22	1765	OLD BEN MINE RESERVOIR	240
23	1740	SILVER LAKE (HIGHLAND)	229
24	1748	VERMILION LAKE	227
25	1708	LAKE CHARLESTON	225
26	1755	FOX LAKE	212
27	1758	SLOCUM LAKE	210
28	1714	LAKE DECATUR	201

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
29	1725	LONG LAKE	195
30	1750	WONDER LAKE	183
31	1752	DEPUE LAKE	139

aD

APPENDIX B

CONVERSIONS FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 75/10/23

171101
39 02 15.0 089 23 10.0
COFFEEN LAKE
17135 ILLINOIS

11EPALES 2111202
3 0048 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/05/07	15 30	0000	23.8		52	590	8.00	74	0.060	0.600	0.420	0.005
	15 30	0006	19.6	7.8		500	8.00	74	0.070	0.400	0.430	0.007
	15 30	0015	18.5	7.6		490	7.90	74	0.080	0.400	0.440	0.009
	15 30	0025	17.7	7.2		490	7.80	73	0.090	0.400	0.450	0.014
	15 30	0035	15.8	6.5		500	7.70	74	0.080	0.400	0.500	0.021
	15 30	0044	13.7	5.2		505	7.70	74	0.070	0.400	0.500	0.026
73/08/10	16 00	0000	37.9		42	641	7.10	70	0.350	0.900	0.110	0.004
	16 00	0005	34.8	6.4		602	7.70	70	0.040	0.700	0.100	0.006
	16 00	0015	31.2	5.2		566	7.10	72	0.060	0.600	0.370	0.010
	16 00	0025	29.6	0.1		534	7.00	73	0.040	0.600	0.350	0.011
	16 00	0035	19.4	0.1		440	7.20	94	0.570	1.000	0.220	0.017
	16 00	0045	14.1	0.3		404	7.20	105	0.820	1.700	0.040	0.022
73/10/18	16 35	0000	28.2		56	590	7.90	83	0.020	0.600	0.080	0.011
	16 35	0005	27.5	7.0		574	7.90	83	0.030	0.400	0.080	0.013
	16 35	0010	24.5	7.2		545	7.80	81	0.020	0.400	0.080	0.011
	16 35	0015	24.0	4.8		521	7.60	79	0.030	0.400	0.140	0.016
	16 35	0025	22.7	5.2		515	7.50	81	0.060	0.400	0.100	0.015
	16 35	0035	22.0	5.2		504	7.50	83	0.130	0.600	0.060	0.020
	16 35	0045	13.9	1.0		490	7.50	138	1.980	2.500	0.020	0.297

STORET RETRIEVAL DATE 75/10/23

171101
39 02 15.0 089 23 10.0
COFFEEN LAKE
17135 ILLINOIS

11EPALES 2111202
3 0048 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/05/07	15 30	0000	0.029	3.7
	15 30	0006	0.032	
	15 30	0015	0.029	
	15 30	0025	0.036	
	15 30	0035	0.045	
	15 30	0044	0.046	
73/08/10	16 00	0000	0.030	5.7
	16 00	0005	0.034	
	16 00	0015	0.025	
	16 00	0025	0.029	
	16 00	0035	0.044	
	16 00	0045	0.055	
73/10/18	16 35	0000	0.028	5.1
	16 35	0005	0.027	
	16 35	0010	0.023	
	16 35	0015	0.022	
	16 35	0025	0.026	
	16 35	0035	0.034	
	16 35	0045	0.343	

HC

STORET RETRIEVAL DATE 75/10/23

171102
39 03 20.0 089 24 30.0
COFFEEN LAKE
17135 ILLINOIS

11EPALES 2111202
3 0034 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/05/07	16 00	0000	20.1		48	495	7.90	75	0.070	0.500	0.410	0.003
	16 00	0006	20.1	8.2		495	8.00	74	0.060	0.500	0.420	0.004
	16 00	0015	20.1	8.0		495	8.00	74	0.060	0.500	0.410	0.004
	16 00	0022	20.0	8.3		495	8.10	74	0.050	0.500	0.410	0.005
	16 00	0030	19.8	8.2		495	8.10	74	0.060	0.400	0.420	0.006
73/08/10	14 35	0000	34.7		36	600	8.20	76	0.040	0.900	0.100	0.005
	14 35	0005	32.2	8.0		580	8.10	75	0.030	0.600	0.090	0.007
	14 35	0015	30.8	6.0		564	7.20	73	0.050	0.700	0.080	0.008
	14 35	0025	29.8	1.4		538	7.20	71	0.060	0.700	0.200	0.011
	14 35	0031	28.2	0.4		492	7.10	75	0.130	0.800	0.100	0.015
73/10/18	16 13	0000	23.7		72	530	8.10	77	0.030	0.500	0.050	0.012
	16 13	0005	23.7	8.0		531	8.00	78	0.030	0.500	0.050	0.013
	16 13	0015	22.9	7.4		520	7.90	79	0.040	0.500	0.060	0.013
	16 13	0030	21.7	7.2		505	7.90	82	0.040	0.600	0.050	0.013

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/05/07	16 00	0000	0.028	5.7
	16 00	0006	0.030	
	16 00	0015	0.032	
	16 00	0022	0.032	
	16 00	0030	0.032	
73/08/10	14 35	0000	0.029	6.6
	14 35	0005	0.028	
	14 35	0015	0.030	
	14 35	0025	0.035	
	14 35	0031	0.048	
73/10/18	16 13	0000	0.025	5.5
	16 13	0005	0.025	
	16 13	0015	0.023	
	16 13	0030	0.035	

STORET RETRIEVAL DATE 75/10/23

171103
39 04 45.0 089 24 50.0
COFFEEN LAKE
17135 ILLINOIS

11EPALES
3

2111202
0015 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/05/07	16 30	0000	17.7		24	430	7.20	77	0.090	0.700	0.460	0.017
	16 30	0006	17.6	8.4		430	7.70	76	0.100	0.600	0.470	0.017
	16 30	0011	17.6	8.6		430	7.90	77	0.090	0.600	0.460	0.015
73/08/10	14 10	0000	30.4		30	536	8.60	76	0.040	0.900	0.040	0.009
	14 10	0005	29.1	7.2		526	8.40	76	0.030	0.900	0.030	0.012
	14 10	0009	28.6	6.0		518	8.00	76	0.030	0.900	0.040	0.016
73/10/18	16 00	0000	20.0		34	479	8.20	74	0.040	0.700	0.020	0.014
	16 00	0010	19.2	7.4		469	7.80	76	0.060	0.500	0.020	0.017

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/05/07	16 30	0000	0.058	11.7
	16 30	0006	0.067	
	16 30	0011	0.061	
73/08/10	14 10	0000	0.046	18.4
	14 10	0005	0.065	
	14 10	0009	0.063	
73/10/18	16 00	0000	0.037	6.9
	16 00	0010	0.062	

APPENDIX D

WASTEWATER TREATMENT PLANT DATA

STORET RETRIEVAL DATE 75/10/23

171121 AS171121 P000110
39 03 20.0 089 23 00.0
HILLSBORO MINE STP (COFFEEN)
17135 MONTGOMERY COUNT
D/COFFEEN LAKE
COFFEEN LAKE
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/08/06	13 45		0.250	5.800	0.420	0.380	0.590	0.028	0.028
73/09/07	10 00		0.320	2.100	0.529	0.200	0.338	0.028	0.028
73/10/05	10 00		0.400	2.100	0.350	0.250	0.380	0.028	0.028
73/11/06	10 00		0.240	3.900	0.260	0.330	0.800	0.028	0.028
73/12/07	10 00		0.250	3.500	0.410	0.447	0.580	0.028	0.028
74/01/07	10 00		0.280	4.900	0.067	0.550	0.710	0.028	0.028
74/02/07	10 00		0.280	4.600	0.190	0.270	0.670	0.028	0.028
74/03/11	10 00		0.480	4.000	0.050K	0.410	0.690	0.028	0.028
74/04/05	10 00		0.160	4.600	0.190	0.410	0.670	0.028	0.028
74/05/13	10 00		0.330	4.000	0.070	0.380	0.870	0.028	0.028
74/06/12	10 00		0.240	3.700	0.050K	0.300	0.620	0.028	0.028
74/07/08	10 00		0.560	1.000K	0.050K	0.410	0.470	0.028	0.028
74/08/16	10 00		0.280	5.000	0.075	0.370	0.610	0.028	0.028

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/10/23

171131 SF171131 P000050
39 03 35.0 089 24 13.0
COFFEEN POWER STATION
17 MONTGOMERY COUNT
D/COFFEEN
COFFEEN
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/08/23	14 00			2.200	0.140	0.378	0.410		0.006
73/09/26	09 00		22.000	0.060	0.058	1.385	1.440	0.006	0.006
74/01/17	08 00		6.100	15.000	5.850	2.640	3.000	0.006	0.006
74/02/16	14 00		18.500	5.700	2.100	4.700	5.100	0.006	0.006
74/03/13	13 30		17.600	1.350	0.050K	3.600	3.900	0.006	0.006
74/04/19	14 00		13.000	1.000K	0.270	1.950	2.100	0.006	0.006
74/05/14	13 30		17.600	2.300	0.160	1.850	2.100	0.006	0.006
74/06/13	11 00		4.200	1.000K	0.115	0.680	0.760	0.006	0.006
74/07/11	13 30		2.320	0.400	0.290	0.895	0.900	0.006	0.006
74/08/14	13 00		14.300	1.000K	0.050K	1.400	1.400	0.006	0.006
74/09/14	10 30		3.500	0.500K	0.068	0.810	0.870	0.006	0.006
74/10/13	15 00		3.520	1.000K	0.050K	0.310	0.370	0.006	0.006

K VALUE KNOWN TO BE
LESS THAN INDICATED